

APPENDIX C.3

HEALTH AND SAFETY

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C.3 Health and Safety

C.3.1 INTRODUCTION

Health and safety impacts to workers and the public can arise from various work-related activities associated with waste processing and facility disposition. Health impacts that were evaluated in this EIS include those resulting from radiological and non-radiological activities and have been presented for the following three types of impacts:

- Radiological health impacts were evaluated for all radiological workers involved with waste processing and facility disposition based on the likelihood of developing a latent cancer fatality (LCF) from worker exposure to radiological air and surface contaminants. Radiological health impacts from facility emissions were also evaluated for the general public, maximally-exposed individual, and noninvolved worker.
- Non-radiological health impacts were presented in terms of the hazard quotient for each type of carcinogenic and noncarcinogenic toxic air pollutant for all workers involved with waste processing and facility disposition activities and the public using estimated site boundary pollutant concentration levels.
- Occupational health and safety impacts were evaluated for all workers involved with waste processing and facility disposition activities based on historical injury and illness data at INEEL.

These health impacts and the methodologies and results used to obtain them are presented in Sections 5.2.10 and 5.3.8 of this EIS.

C.3.2 RADIOLOGICAL HEALTH IMPACTS

For calculating worker radiological health impacts, Project Data Summaries and supporting Engineering Design Files (see Appendix C.6) were used as sources of information on the number of radiological workers and estimated average radiation dose per worker, and duration of each project within a specific option or alternative. Data were then used to determine the annual average collective dose (person-rem), the total project phase collective worker dose (person-rem), and the estimated increase in the number of LCFs from the total collective worker dose. The LCF value is calculated by multiplying the total collective worker dose by the appropriate dose-to-risk conversion factor based on the *1993 Limitations of Exposure to Ionizing Radiation* (NCRP 1993). These risk factors are 0.0005 and 0.0004 LCFs per person-rem of radiation exposure to the general public and worker population, respectively. The factor

for the population is slightly higher due to the presence of infants and children, which are more sensitive to radiation than the adult worker population. Data on worker radiological health impacts are presented separately for construction, operations, and dispositioning activities.

Radiological health impacts from facility emissions are presented for the maximally-exposed offsite individual, the maximally-exposed onsite worker, and the general public. Estimates of radiological dose are presented in Sections 5.2.6 and 5.3.4. These doses are then integrated for the duration of the project phase for each category above. LCF estimates are calculated for the population based on the total collective dose.

C.3.2.1 Waste Processing

Table C.3-1 provides radiological dose and LCFs during construction activities by project. Data are presented in terms of annual and integrated impacts to involved workers.

Table C.3-2 provides radiological dose and LCFs during operations activities by project. Data are presented in terms of annual and integrated impacts to involved workers.

Radiological impacts from facility airborne emissions to the maximally-exposed onsite and offsite individuals and general population within 50 miles of INEEL is based on worker and radiological dose data presented in Appendix C.2, Table C.2-9. Collective population data from Table C.2-9 was multiplied by the dose-to-risk conversion factor of 0.0005 for the general public to determine LCFs in Section 5.2.10.

C.3.2.2 Facility Disposition

Section C.3.4.2 discusses radiological impacts for the involved workers by project for the existing facilities during facility disposition activities.

C.3.3 NONRADIOLOGICAL HEALTH IMPACTS

For nonradiological health impacts from atmospheric releases, DOE used toxic air pollutant emissions data for each project under an alternative to estimate air concentrations at the INEEL site boundary. For the evaluation of occupational health effects, the modeled chemical concentration is compared with the applicable occupational standard that provides levels at which no adverse effects are expected, yielding a hazard quotient. The hazard quotient is a ratio between the calculated concentration in air and the

applicable standard. For noncarcinogenic toxic air pollutants, if the hazard quotient is less than 1, then no adverse health effects would be expected. If the hazard quotient is greater than 1, additional investigation would be warranted. For carcinogenic toxic air pollutants, risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the potential carcinogen.

Section 5.2.10 presents the waste processing options with the maximum carcinogenic and non-carcinogenic pollutant maximum concentrations based on data from Appendix C.2, Table C.2-12. Table C.2-12 provides maximum pollutant concentrations by each of the projects within the waste processing options.

C.3.4 OCCUPATIONAL HEALTH AND SAFETY IMPACTS

Estimates of occupational illness and injury rates for workers involved with the waste processing alternatives are provided in terms of lost workdays and total recordable cases that would occur during a peak employment year and for the entire period of construction and operations for each of the alternatives. The lost workday values represent the number of workdays beyond the day of injury or onset of illness the employee was away from work or limited to restricted work activity because of an occupational injury or illness. The total recordable cases include work-related death, illness, or injury that resulted in loss of consciousness, restriction of work or motion, transfer to another job, or required medical treatment beyond first aid.

Historical total recordable cases and lost workday rates were obtained from the Computerized Accident/Incident Reporting System (CAIRS) database (Millet 1998) for Idaho construction and operations activities over a 5-year and 15-year period, respectively. These rates are computed using the following formula to determine the number of lost workdays and total recordable cases:

$$\text{LWD} = \text{LWD rate} \times (\text{Employee hours worked}/200,000 \text{ hours})$$

$$\text{TRC} = \text{TRC rate} \times (\text{Employee hours worked}/200,000 \text{ hours})$$

where:

$$\text{LWD} = \text{lost workday, TRC} = \text{total recordable case}$$

The 200,000 in the formula represents the equivalent of 100 employees working 40 hours per week for 50 weeks per year and provides the standard base for incidence rates.

Section 5.2.10 provides estimates of annual and cumulative lost workdays and total recordable cases by alternative during construction and operations for the waste processing alternatives.

The following information is in support of the worker safety information provided in Section 5.2.10 and 5.3.8 for waste processing and facility disposition respectively:

C.3.4.1 Waste Processing

Tables C.3-3 and C.3-4 provide the number of peak-year and total workers and the lost workdays and total recordable cases by project during construction.

Table C.3-3. Worker safety during construction - peak year employment levels.

Project	Number of workers ^a	Lost workdays/year ^b	Total recordable cases/year ^c
No Action Alternative	21	6.7	0.80
Continued Current Operations Alternative	89	28	3.4
Separations Alternative			
Full Separations Option	850	270	32
Planning Basis Option	870	280	33
Transuranic Separations Option	680	210	26
Non-Separations Alternative			
Hot Isostatic Pressed Waste Option	360	110	14
Direct Cement Waste Option	400	130	15
Early Vitrification Option	330	100	13
Minimum INEEL Processing Alternative	200	63	7.5

a. For peak year employment levels, see Appendix C.1.

b. Lost workday rate used to calculate lost workdays is 31.6 based on a 5-year historical average at INEEL for construction workers from 1992-1997.

c. Total recordable cases rate used to calculate total recordable cases is 3.8 based on a 5-year historical average at INEEL for construction workers from 1992-1997.

Tables C.3-5 and C.3-6 provide the number of peak-year and total workers and the lost workdays and total recordable cases by project during operations.

C.3.4.2 Facility Disposition

Table C.3-7 provides peak-year employment and worker safety data by alternative. Project specific employment numbers are provided in Appendix C.1.

Table C.3-8 contains estimated radiological impacts and occupational worker data for existing facilities by project.

Table C.3-5. Worker safety during operations - peak year employment levels.

Project	Number of workers ^a	Lost workdays/year ^b	Total recordable cases/year ^c
No Action Alternative	80	18	2.6
Continued Current Operations Alternative	280	63	8.9
Separations Alternative			
Full Separations Option	440	100	14
Planning Basis Option	410	92	13
Transuranic Separations Option	320	72	10
Non-Separations Alternative			
Hot Isostatic Pressed Waste Option	460	100	15
Direct Cement Waste Option	530	120	17
Early Vitrification Option	330	74	11
Minimum INEEL Processing Alternative	330	74	11

a. For peak year employment levels, see Appendix C.1.

b. Lost workday rate used to calculate lost workdays is 31.6 based on a 5-year historical average at INEEL for construction workers from 1992-1997.

c. Total recordable cases rate used to calculate total recordable cases is 3.8 based on a 5-year historical average at INEEL for construction workers from 1992-1997.

Table C.3-7. Estimated worker injury impacts during dispositioning activities of new facilities at INEEL by alternative.

Project	Dispositioning peak year employment levels		
	Number of workers ^a	Lost workdays/year ^b	Total recordable cases/year ^c
Continued Current Operations Alternative	140	43	5.2
Separations Alternative			
Full Separations Option	790	250	30
Planning Basis Option	780	250	30
Transuranic Separations Option	730	230	28
Non-Separations Alternative			
Hot Isostatic Pressed Waste Option	450	140	17
Direct Cement Waste Option	420	130	16
Early Vitrification Option	320	100	12
Minimum INEEL Processing Alternative	320	100	12

a. For peak year employment levels, see Appendix C.1.

b. Lost workday rate used to calculate lost workdays is 31.6 based on a 5-year historical average at INEEL for construction workers from 1992-1997.

c. Total recordable cases rate used to calculate total recordable cases is 3.8 based on a 5-year historical average at INEEL for construction workers from 1992-1997.

References

NCRP (National Council on Radiation Protection and Measurements), 1993, *Limitations of Exposure to Ionizing Radiation*, Report Number 116, Washington, D.C.

Millet, B., 1998, *CAIRS Database Statistical Summary Profile*, facsimile transmittal to J. Beck, Lockheed Martin Idaho Technologies Company, October 13.